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Species Composition and Density of Liana along the Watershed Area in Pergau, Jeli, Kelantan, Peninsular Malaysia

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Species Composition and Density of Liana along the Watershed Area in Pergau, Jeli, Kelantan, Peninsular Malaysia

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Abstract. A preliminary inventory of liana species composition and density in 0.15 ha of a managed watershed area in Pergau, Jeli northern part of Kelantan, Peninsular Malaysia operated by Tenaga Nasional Berhad, recorded a total of 67 liana individuals (≥ 1 cm dbh) belonging to six genera and five families. The overall liana population density was equivalent to 446 ha⁻¹. The Shannon-Wiener and Fisher's α indices of the inventory were low with 1.44 and 1.59 respectively. Simpson value index was intermediate high, 0.80. *Gynochthodes umbellata* was found to be the most abundant species comprising 26.8% of the proportional abundance with density of 120 ha⁻¹. *Epipremnum giganteum* was recorded as the second most abundant species with 22.4% of abundance and population density of 100 ha⁻¹. The *Agelaea* sp. comprising of 19.4% of abundance, equivalent to a liana density of 86.7 ha⁻¹. The least abundance was *Uncaria* sp. with 8.9% of the proportional abundance and density of 40 ha⁻¹. Both *Spatholobus auritus* and *Marsedenia maingayi* were among the three least proportional abundance of 11.9% and 10.5% whilst the population density of 53.3 ha⁻¹ and 46.7 ha⁻¹ respectively. It could be suggested that ecosystems along the Sungai Long II in Pergau have been disturbed, based on the high abundance of liana. Nevertheless, the existence of lianas within the vicinity play a vital ecological services in sustaining ecosystem productivity through nutrient cycling and also food provisions for frugivore fauna. To ensure the stability of the ecosystem, regular silviculture treatment should also be executed in the highly liana infected area. The uniqueness of certain liana stems tangling in the area could be part of tourist attraction in Pergau, Jeli.

1. Introduction

In tropical forests, lianas (woody climbers) add both physical structure and resources to the forest. Their flowers and fruits provide nutrients to a wide variety of invertebrates and vertebrates and their leaves are used as oviposit hosts for lepidopterans and resources for other forest insects [1]. Their tangled stems accumulate leaf litter that provides habitat for invertebrates as well as the birds that feed on those invertebrates [2]. Even the physical structure created by lianas via their stems crossing from tree to tree is used as perches and walkways for vertebrates whose lives may be spent almost entirely in the canopy. Lianas contribute roughly 20% of the woody plant species in surveys of lowland,



neotropical forests [3]. With such high relative species importance, increasing interest has been focused on the role of lianas in tropical forest dynamics [4].

In a managed or damaged ecosystems, lianas can overtop trees, causing arrested succession and promoting fast-growing weedy tree species over slow growing tree species more typical of undisturbed forests. In areas where timber extraction dictates some liana management, liana cutting decreases biodiversity [5], but the species of lianas that remain or regenerate after cutting have not yet been classified as either invaders or primary forest species. By virtue of liana cutting does result in abundant resprouting [5], it is important not only to monitor changes in stem density, but also in species composition. Grasping the knowledge on liana distribution patterns and the factors controlling them is crucial for reliable predictions of future alteration due to climate changes and disturbance occurrence in tropical forests.

This paper reports the results of a preliminary inventory of liana species composition and density in 0.15ha plot along the watershed area of Sungai Long II intake in Pergau, Jeli, northern part of Kelantan.

2. Methodology

2.1 Study area

The preliminary inventory was conducted in 0.15ha along the watershed area of Sungai Long Intake II in Pergau, Jeli, Kelantan, Peninsular Malaysia. This watershed area is part of reservoir for Pergau Dam, operated by Tenaga Nasional Berhad after it was officially opened in 2003. The area represents the lowland vegetation with approximately 450m asl. Within the vicinity, the canopy was moderately wide and the emergents were approximately not exceeding 45m.

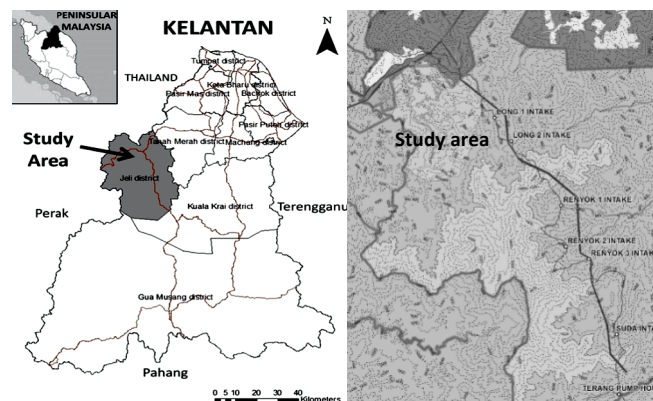


Figure 1. The location of study site along the watershed area of Sungai Long II Intake in Pergau, Jeli

2.1 Sampling method

The inventory of lianas was carried out in November 2019, following the protocol by Gerwing et al. [6]. All liana stems (ramets) ≥ 1 cm in dbh were inventoried and the dbh was measured with a caliper at 1.3 m above the ground. The tree mainly supporting a liana was recorded as its host tree. The diameters of all host trees (dbh ≥ 10 cm) were measured at 1.3 m above the ground.

2.3 Data analyses

All the collected data were tabulated accordingly and the alpha diversity of lianas were estimated using the equations of Shannon Weiner Index, Simpson Diversity Index and Fisher's α Diversity Index.

3. Results

3.1 Species richness and diversity

A total of 67 liana individuals (≥ 1 cm dbh) belonging to 6 genera and 5 families were recorded in 0.15ha plot (Table 1). Liana species richness in the study area was recorded low with 6 species. The study site scored a low value of Shannon but Simpson's value was intermediate high. The Fisher's α index was found to be below 10 with the value of 1.59.

Table 1. Summary of liana diversity inventory (≥ 1 cm dbh) in 0.15ha plot in Sungai Long II watershed area in Pergau, Jeli, Kelantan.

Variable	Number/Value
Species richness	6
No. of genera	6
No. of families	5
Diversity indices	
(i) Shannon-Wiener	1.44
(ii) Simpson	0.80
(iii) Fisher's α	1.59

3.2 Species population density

The population density of the six liana species in 0.15ha was tabulated in Table 2. In total 67 individual of lianas were counted in 0.15ha, equivalent to a liana density of 446 ha⁻¹. *Gynochthodes umbellata* was found to be the most abundant species comprising 26.8% of the proportional abundance with density of 120 ha⁻¹. *Epipremnum giganteum* was recorded as the second most abundant species with 22.4% of abundance and population density of 100 ha⁻¹. The *Agelaea* sp. comprising of 19.4% of abundance, equivalent to a liana density of 86.7 ha⁻¹. The least abundance was *Uncaria* sp. with 8.9% of the proportional abundance and density of 40ha⁻¹. Both *Spatholobus auritus* and *Marsdenia maingayi* were among the three least proportional abundance of 11.9% and 10.5% whilst the population density of 53.3 ha⁻¹ and 46.7 ha⁻¹ respectively.

Table 2. Population density of liana (≥ 1 cm dbh) in 0.15ha plot in Sungai Long II watershed area in Pergau, Jeli, Kelantan

No.	Family	Species	Density (ha ⁻¹)
1.	Araceae	<i>Epipremnum giganteum</i>	100
2.	Apocynacea	<i>Marsdenia maingayi</i>	46.7
3.	Connaraceae	<i>Agelaea</i> sp.	86.7
4.	Leguminosae	<i>Spatholobus auritus</i>	53.3
5.	Rubiceae	<i>Gynochthodes umbellata</i>	120
6.		<i>Uncaria</i> sp.	40

4. Discussion

Species richness and diversity of lianas enumerated in watershed area along the Sungai Long II Intake in Pergau, Jeli appears to be lower within a small size of sampling site, 0.15ha. The Shannon-Wiener index was low with 1.47. The value of the Shannon-Wiener Index usually lies between 1.5 and 3.5 for ecological data and rarely exceeds 4.0. Fisher's α index of the inventory site was also recorded low

with value of 1.59. Simpson value was intermediate high, 0.80. Specifically, the Simpson index value of 1 means high in diversity. Based on the Simpson Index, it was likely to be 80% chance of tendency obtaining two species that are different within the vicinity.

It is notable that Rubiceae, Araceae and Connaraceae constituted the predominantly liana families by density within the vicinity. According to Homeier et al. [7] the forest structural attributes such as tree diameter and tree basal area are more influential for liana abundance, basal area and diameter distribution patterns than soil parameter. Certain other recent studies reached similar conclusion, van der Heijden and Philips [8] postulated that success of lianas might depend more on the availability of suitable host trees than on soil conditions.

Although the consensus of liana proliferation led to poor carbon sequestration in the forest, a high liana abundance in the watershed area particularly along the Sungai Long II has a potential impact in preventing the soil erosion. Fast growth and build up leaf cover by lianas may prevent rain-related erosion of bare soil exposed by disturbance [9]. Temporal storage in liana foliage and later redistribution via litterfall may prevent nutrients from being leached from tropical soil. Schnitzer and Bongers [9] also postulated that the high concentrations of potassium in liana leaves may be of vital importance for ecosystem productivity.

Apart from that, liana also play a vital role in providing essential food resources to frugivore animals. Nevertheless, the number of lianas should be in equilibrium within the ecosystem to ensure the mortality rate of infested trees is not posing a hazardous threat to the surrounding productivities.

5. Conclusion

It could be suggested that ecosystems along the Sungai Long II in Pergau have been disturbed, this was based on the high abundance of liana. Nevertheless, the existence of lianas within the vicinity play a vital ecological services in sustaining ecosystem productivity through nutrient cycling and also food provisions for frugivore fauna. To ensure the stability of the ecosystem, regular silviculture treatment should also be executed in the highly liana infected area. The uniqueness of certain liana stems tangling in the area could be part of tourist attraction in Pergau, Jeli.

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